Upper San Joaquin River Basin Storage Investigation

Draft Surface Storage Option Technical Memorandum

Mill Creek Reservoir

Prepared for

U.S. Bureau of Reclamation
Mid Pacific Region

By

MWH
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March 2003

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TECHNICAL MEMORANDUM

MILL CREEK RESERVOIR
UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION

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EXECUTIVE SUMMARY

An appraisal-level study of a potential Mill Creek Dam and Reservoir was completed as part of the Upper San Joaquin River Basin Storage Investigation (Investigation). The Investigation is being completed by the U.S. Bureau of Reclamation Mid-Pacific Region, in cooperation with the California Department of Water Resources, consistent with recommendations in the CALFED Bay Delta Program Record of Decision, August 2000.

Mill Creek Dam would be a new structure constructed on Mill Creek, a tributary that joins the Kings River approximately 1.7 miles downstream from Pine Flat Dam. Mill Creek Dam would impound a reservoir with a storage capacity of up to 200,000 acre-feet.

As originally proposed by the Kings River Conservation District (KRCD), Mill Creek Dam would be a zoned embankment structure 250 feet in height with a crest length of 3,700 feet at an elevation of 830 feet above mean sea level (elevation 830). The reservoir gross pool would be at elevation 800. The dam would impound Mill Creek flows as well as water diverted by gravity from Pine Flat Reservoir through a 10-foot diameter, 5,000-foot long, unlined tunnel.

Water stored in Mill Creek Reservoir would be released to the Kings River and diverted to the Friant-Kern Canal or left instream. These flows would be exchanged for water delivered from Millerton Lake via canal or released from Millerton to the San Joaquin River. The estimated first cost of constructing Mill Creek Dam is $296 million.

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CHAPTER 1. INTRODUCTION

The U.S. Bureau of Reclamation (Reclamation), in cooperation with the California Department of Water Resources (DWR), is completing the Upper San Joaquin River Basin Storage Investigation (Investigation) consistent with the CALFED Bay Delta Program Record of Decision (ROD), August 2000. The Investigation will consider opportunities to develop water supplies to contribute to water quality improvements in and restoration of the San Joaquin River and to enhance conjunctive management and exchanges to provide high quality water to urban areas. The ROD indicated that the Investigation should consider enlargement of Friant Dam or development of an equivalent storage program to meet Investigation objectives.

The Investigation identified several potential surface storage sites to be initially considered through appraisal-level studies of engineering and environmental issues. This Technical Memorandum presents findings from an appraisal-level review of the potential Mill Creek Dam and Reservoir.

PROJECT DESCRIPTION

The proposed Mill Creek Dam and Reservoir would be located in Fresno County, 26 miles east of the city of Fresno. The dam site is located on Mill Creek, roughly one mile upstream of its confluence with the Kings River. Figure 1-1 shows the general project location and Figure 1-2 shows Mill Creek and vicinity.

Mill Creek Reservoir would have a storage capacity of up to 200,000 acre-feet at a gross pool elevation of 800 ft above mean sea level (elevation 800). The dam would impound Mill Creek flows as well as water diverted from Pine Flat Reservoir through a 10-foot diameter, 5,000-foot long, unlined tunnel.

Water stored in Mill Creek Reservoir would be released to the Kings River and diverted to the Friant-Kern Canal or left instream. These flows would be exchanged for water delivered from Millerton Lake via canal or released from Millerton to the San Joaquin River.

EXISTING FACILITIES

No water storage facility presently exists at the Mill Creek site.

Pine Flat Dam and Reservoir are located on the Kings River about 1.7 miles upstream of its confluence with Mill Creek. Pine Flat Dam was constructed in 1954 by the U.S. Army Corps of Engineers (Corps) to provide flood protection to downstream properties. The dam is owned and operated by the Corps and has a storage capacity of one million acre-feet. In 1984, Kings River Conservation District (KRCD) constructed Pine Flat Power Plant at the downstream toe of the dam on the right abutment. Pine Flat Power Plant is owned and operated by KRCD.

The Friant-Kern Canal, part of the Federal Central Valley Project, crosses the Kings River about 8 miles downstream Pine Flat Dam. There are also numerous flood control levees and irrigation distribution systems downstream of Pine Flat Dam.

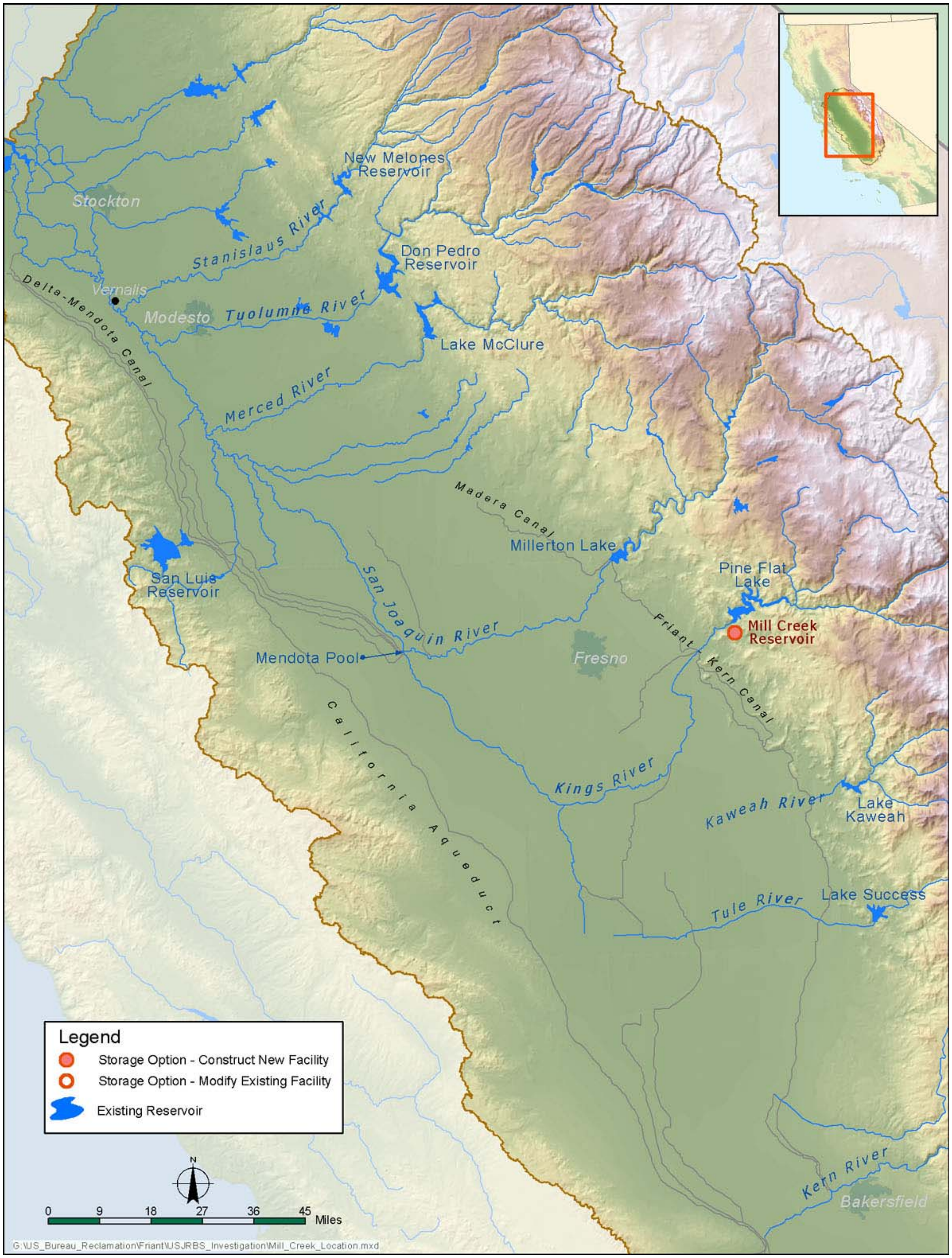

FIGURE 1-1. MILL CREEK SITE LOCATION MAP

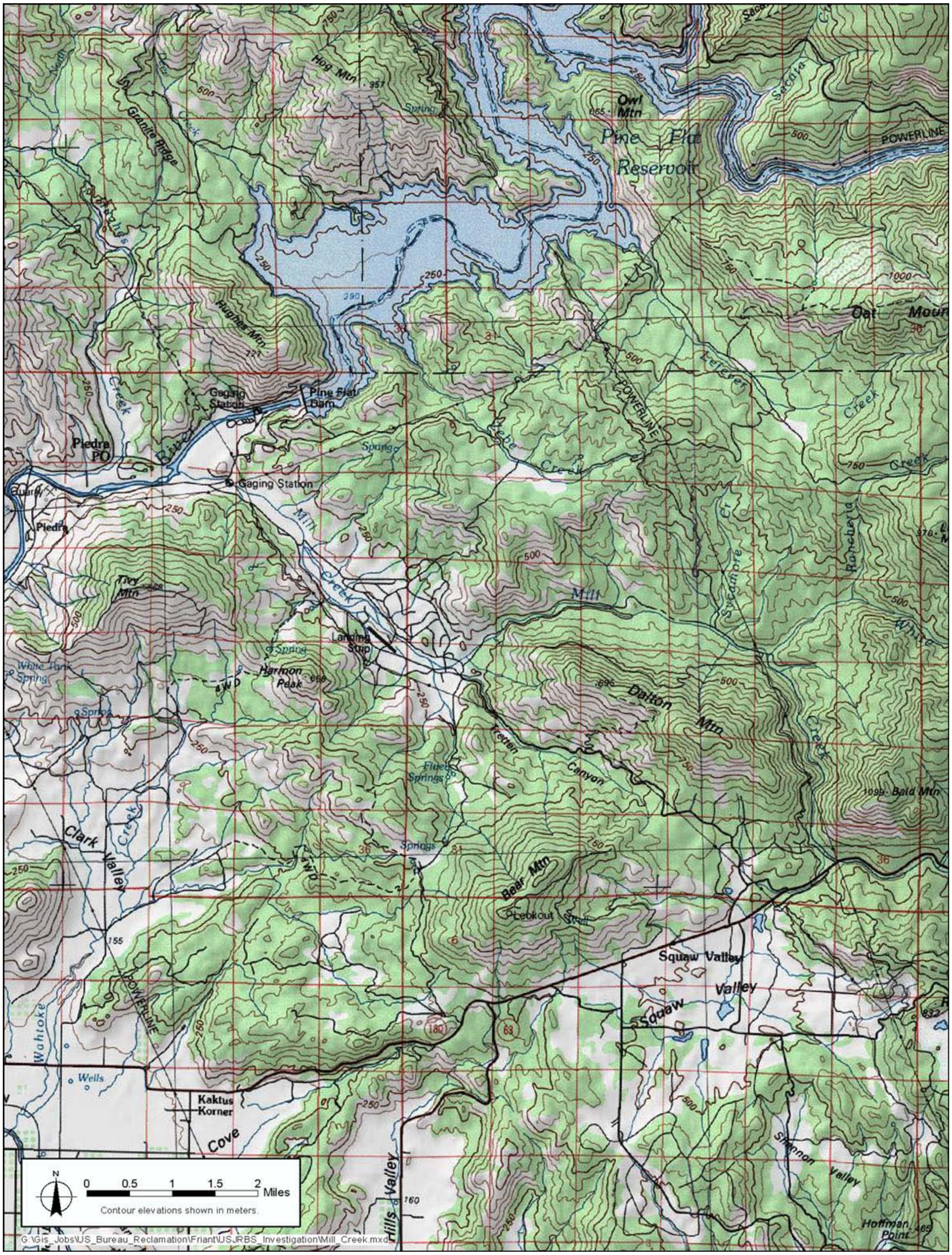

FIGURE 1-2. MILL CREEK AND VICINITY

SUMMARY OF PREVIOUS INVESTIGATIONS

In 1965, a Committee of Engineers issued a Progress Report on the Kings River Water Utilization Projects Upstream from Pine Flat Reservoir for the Kings River Water Association (KRWA). The report evaluated three alternative storage sites that included Junction Dam (on the main stem of the Kings River just downstream of its confluence with the North Fork); Rodgers Crossing Dam (on the main stem just upstream of the North Fork confluence); and Mill Creek Dam (on Mill Creek, which joins the Kings River from the south, just downstream of Pine Flat Dam).

Mill Creek Dam was not considered economically feasible at the time of the KRWA investigation. The committee also concluded that the project would not become feasible in the future. It was recommended that the Mill Creek Dam and Reservoir be eliminated from further consideration.

In 1974, a Master Plan of the Kings River Service Area was carried out on behalf of the Kings River Conservation District (KRCD) by International Engineering Company, Inc. (IECO, 1974). The purpose of the Master Plan was to recommend a course of action that would: 1) provide a balanced water supply; 2) minimize flood damage; and 3) conserve and develop water and power resources. One of the alternatives evaluated consisted of the potential 250-foot high, zoned rockfill dam at Mill Creek. The report concluded that the service area was deficient in water, and that unless additional water supplies were obtained, groundwater would be overdrafted to the point where a large segment of the agricultural service area would ultimately have to revert to dry farming.

To address the issue, IECO concluded that a staged development of the recommended alternatives be pursued. The Mill Creek Dam alternative was not considered economically feasible at the time of the investigation, but was retained as an alternative because future economic conditions might render it feasible.

PROPOSED IMPROVEMENTS

As proposed in the KRCD Master Plan, Mill Creek Dam would be a 250-foot high, zoned rockfill structure with a crest 3,700 feet long and 30 feet wide at an elevation of 830 feet above mean sea level (elevation 830). The dam would create Mill Creek Reservoir with a storage capacity of about 200,000 acre-feet at gross pool elevation 800. The dam would impound Mill Creek flows as well as water diverted from Pine Flat Reservoir through a 10-foot diameter, 5,000-foot long, unlined tunnel. The tunnel would be sized for a maximum discharge of 2,500 cubic feet per second (cfs).

An ungated, 150-foot wide spillway would be on the left abutment. The spillway would consist of an excavated approach channel, a 1,900-foot long, 150-foot wide concrete-line chute, a 130-foot long hydraulic-jump stilling basin, and an exit channel to Mill Creek. The spillway crest would be at elevation 800. Discharge at water surface elevation 810 would be 11,600 cfs; at elevation 820, discharge would be 35,000 cfs.

The intake and portal structure would be located in the left abutment and would include trashracks and slots for a bulkhead or stoplogs. The 2,000-foot long outlet tunnel would have upstream and downstream diameters of 10 and14 feet, respectively. An emergency valve chamber would be provided in the tunnel and a 1,100-foot long, 4-foot diameter steel conduit would carry irrigation flows from the emergency valve chamber to the outlet structure.

APPROACH AND METHODOLOGY

This Technical Memorandum (TM) was prepared from a brief review of the prior studies listed above, an engineering field reconnaissance on 13 June 2002 (Appendix A), and an environmental field reconnaissance of the dam and reservoir made on 29 May 2002 (Appendix B).

During the June 2002 field trip, engineers and geologists examined the site under consideration. Locations of existing and proposed structures were visually assessed. Topography, geology, geotechnical conditions, and utilities were noted. Access routes were considered, as well as possible borrow, staging, and laydown areas.

During the environmental field review, specialists in botany, wildlife, aquatic biology, recreational resources, and cultural resources visually assessed existing environmental resources. Additional research was conducted, making use of prior studies and available literature, the California Natural Diversity Database, topographic maps, and aerial photographs. This information was used to preliminarily identify the extent to which potential environmental impacts might constrain the storage options under consideration. Where evident, opportunities for improving environmental resources or mitigating adverse effects were also noted. Surveys and consultations with external resource management or environmental agencies were not conducted.

The seismotectonic evaluation conducted by Reclamation for this study was based on readily available information and is considered appropriate for appraisal-level designs only. Detailed, site-specific seismotectonic investigations have not been conducted and remotely-sensed imagery was not evaluated. More detailed, site-specific studies would be required for higher-level designs.

For planning level studies, designs and analyses are typically quite general. Extensive efforts to optimize the design have not been done, and only limited Value Engineering (VE) techniques have been utilized.

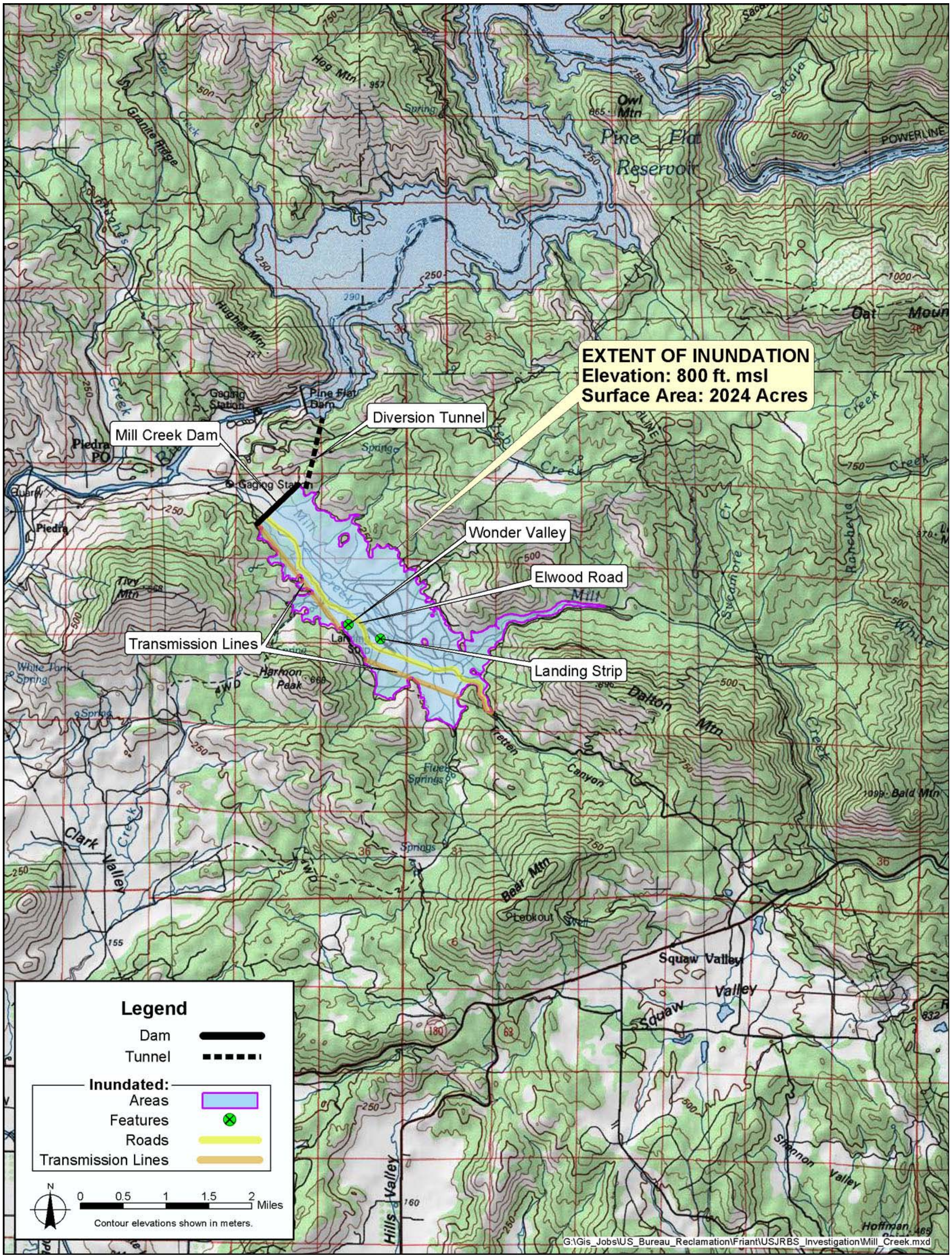

FIGURE 1-3. POTENTIAL MILL CREEK RESERVOIR INUNDATION AREA

CHAPTER 2. TOPOGRAPHIC SETTING

TOPOGRAPHY

Regional topography is that of a nearly level floor of the San Joaquin Valley rising abruptly to moderately steep, northwest-trending foothills with rounded canyons. Elevations in the immediate area range from about elevation 600 to nearly elevation 2,400.

Farther east, the terrain steepens and the canyons become more incised. The canyons have been cut by southwest- to west-flowing rivers and associated large tributaries. The Kings River is the main river in the area. The topography of the Kings River basin is the most rugged in the entire Sierra Nevada, rising to over elevation 14,000 in the upper watershed.

The Wonder Valley area consists of a northwest trending, relatively broad (1 mile), short (3 miles), flat-bottomed valley rimmed by moderately steep, to steep slopes. Somewhat sharper ridges and mountains surround most of the downstream portion of the valley and rise to elevations of over 2,800 feet. The more round-topped Dalton Mountain (elevation 3,500) dominates the head of the main valley. The right dam abutment rises at a slope inclination of about 3.5:1 (horizontal to vertical), while the left abutment rises at about 2.5:1.

AVAILABLE TOPOGRAPHIC MAPPING

Topographic maps of the area are publicly available from the U. S. Geological Survey (USGS). It is likely that topographic maps of the reservoir and dam site are held by the Corps at an unknown scale and contour interval.

AVAILABLE AERIAL PHOTOGRAPHY

Aerial photography of various scales and imagery is available from the archive files of the U.S. Geological Survey. Additional aerial imagery may also be available from the U.S. Department of Agriculture, Reclamation, and the Corps. A specific search of the available photography was not conducted for this Technical Memorandum nor were any existing aerial photographs reviewed.

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CHAPTER 3. GEOLOGIC AND SEISMIC SETTING

REGIONAL GEOLOGY AND SEISMICITY

The Mill Creek area is located near the boundary of the Sierra Nevada Geomorphic Province and the San Joaquin Valley portion of the Great Valley Geomorphic Province. The Great Valley basin is filled with thick accumulations of marine (at depth) and non-marine sediments shed largely from the Sierra Nevada mountain range. Recent alluvium of lake and river origin blanket most of the present-day surface, while dissected remnants of Pleistocene alluvial fans rim the valley margin.

The Kings River basin is within a complex geologic area containing pre-Cretaceous meta-sedimentary and meta-volcanic rocks that have been folded, faulted, and intruded by granitic rocks of three different ages. Volcanism, followed by glaciation and recent stream down-cutting, has modified the topography to essentially the present day landscape. Major geologic structures trend to the northwest. Bedding and foliation of the rock units typically strike northerly and dip steeply west. The degree of weathering and jointing is variable, depending on rock type.

Overall, potential seismic hazard potential at the site is low. A preliminary earthquake loading analysis, for this appraisal-level evaluation, considered two types of potential earthquake sources, fault sources and areal/background sources.

Twenty-two potential fault sources for the project site were identified. They included those associated with the San Andreas fault, seven western Great Valley faults, seven eastern Sierra Nevada faults, the White Wolf fault of the southern San Joaquin Valley, and six faults of the Sierra Nevada Foothills system. No major through-going or shear zones have been identified in this area of the Sierra Nevada and historic seismicity rates are low.

The areal/background seismic source considered was the South Sierran Source Block (SSSB), the region surrounding the project site. This region possesses relatively uniform seismotectonic characteristics.

Probabilistic seismic hazard analysis shows that the peak horizontal accelerations to be expected at the site are 0.13g with a 2,500-year return period, 0.17g with a 5,000-year return period, and 0.23g with a 10,000-year return period.

SITE GEOLOGY AND FAULTING

The proposed Mill Creek Dam and Reservoir are located near the boundary of the Sierra Nevada foothills and the Great Valley. The state geologic map shows that the area to the north of the lower part of the reservoir is a complex of geologic units comprising pre-Cenozoic granitics, and Mesozoic granitics. Pre-Cretaceous basic intrusive rocks and Mesozoic granitics are shown south of the proposed reservoir. Dalton Mountain, in the upper reaches of the reservoir area, is composed of pre-Cretaceous meta-volcanic rock. Recent alluvium fills the valley bottom.

IECO (1974) describes the rock in the right abutment as consisting of metamorphics with scattered aplite dikes and quartz seams. The left abutment is described as being composed of granitic and basic intrusive rocks.

SITE GEOTECHNICAL CONDITIONS

As described by IECO in 1974, the proposed right abutment is underlain by hard, slightly weathered metamorphic rock, which outcrops high on the abutment. Here, the rock is fractured and contains scattered aplite dikes and quartz seams ranging from 1- to 6-inches thick. Near the base of the abutment, there are a few large boulders of metamorphic rock surrounded by slope wash.

Both granitic and basic intrusive rocks crop out on the left abutment. The geologic contacts are covered by slope wash. The rocks here are presumably fractured and weathered. The gray basic intrusive rock is hard, fractured and slightly weathered. Highly weathered and decomposed granitic rock is exposed in the shallow cuts of the power line access road (elevation 800), both downstream and higher on the abutment. This weathering may penetrate to a considerable depth. Consequently, hard and soft zones would be expected during excavation. Typically, the slope wash is shallow, increasing in thickness near the valley floor. Downstream of the proposed dam site there is an alluvial fan deposit.

The proposed spillway location, high on the left abutment, is underlain by intrusive rocks. The near surface materials are characterized by decomposed granite containing scattered, hard, angular fragments. The overlying slope wash is shallow.

Based on previous subsurface exploration by Reclamation, it appears that the depth of the overlying alluvial material is variable, but in general is more than 15 feet below ground surface. The alluvium is composed of stratified river-deposited sand and gravel that locally contains lenses of well-graded material. Only a small percentage of silt size material is present, although some silty sand layers were noted near the ground surface. The gravels are predominately less than 6 inches in diameter, but a few boulders up to 2 feet in diameter were observed.

Significant landslides were not observed. However, slumps and minor slides could occur on filling the reservoir. Seepage is not expected to be a problem, even though the underlying bedrock is fractured.

CHAPTER 4. HYDROLOGIC SETTING

DRAINAGE AREA

The proposed Mill Creek damsite is approximately 3,500 feet upstream from Gaging Station No. 2217 and 1.3 miles upstream from the confluence of Mill Creek and the Kings River. The drainage area at the gage is 127 square miles. The mean annual discharge is 32,240 acre-feet.

RAINFALL

Rainfall in this Mediterranean climate region varies from about 8 or 9 inches per year in the valley to about 60 inches per year in the Sierra Nevada. About 90 percent of runoff producing precipitation occurs during the months of November through April.

Precipitation usually occurs as rain at elevations below 4,000 feet and as snow at higher elevations. However, snow has occurred in the San Joaquin Valley and rain sometimes occurs at elevations above 10,000 feet. The snow pack accumulates during the winter and early spring and generally starts melting in April. At the Piedra stream gaging station, just downstream of Pine Flat Dam, April to July runoff accounts for an average of about 75 percent of the total annual runoff.

EROSION, RUNOFF, AND RECHARGE

Specific soils/erosion potential information for the site was not identified. It is expected that the soils in the Kings River basin could be broadly classified into two types. One is shallow, well-drained, slightly acidic, rocky, medium textured, and developed on slates, schists, volcanic debris, and serpentine bedrock. Soils of this type are reasonably stable with adequate vegetation.

The other soil type would be moderately deep, moderately coarse-textured, well drained, slightly acidic, and granitic. Soils of this type are subject to severe erosion.

Farther southwest along the Kings River, the flood plain area would consist of moderately deep, nearly level to gently rolling well-drained loams underlain with hardpan.

Steam flow data has been collected at gaging stations in the Kings River basin by the USGS, Corps, and local agencies for a varying number of years. The gage at Piedra has been in operation since 1895, it provides the longest continuous set of flow data available. Discharge records for Mill Creek are available from 1938 to the present. They were extended back to water-year 1922-23 by a flow frequency study (annual basis) with Kings River flows at Piedra to estimate the distribution of monthly flows. According to the 1974 IECO report, average annual flow at Mill Creek is 36 cfs, with a maximum average flow of 213 cfs, and a minimum annual average of 2 cfs.

AVAILABLE FLOOD DATA

Detailed flood data were not identified in the documents reviewed. There are two types of flood flows on the Kings River; winter rain floods and spring snowmelt floods. The winter rain floods, which occur during the period from November through March, are caused by heavy rains and are characterized by sharp, high peaks of short duration and comparatively small volumes. The snowmelt floods occur during the period from March through June. While not producing the high peak flows of winter-type floods, they have a much larger runoff volume.

The recorded history of flooding in the Kings River basin extends to 1895. Major flood years were 1966, 1969, and 1978. The snowmelt in 1966 was 290 percent of normal. In 1969, snowmelt was even greater, exceeding all previous recorded years. In that year, flood control releases to the San Joaquin River from Pine Flat Dam totaled 1,017,000 acre-feet. For reference, Pine Flat Dam was designed to control outflow to a maximum of 17,100 cfs (COE, 1989b).

CHAPTER 5. ENVIRONMENTAL SETTING

INTRODUCTION

This chapter describes existing environmental resources at the site and qualitatively describes potential effects of reservoir development. The discussion in this chapter is intended to indicate the extent to which expected or potential environmental effects might pose a constraint to reservoir development. Where evident, opportunities for improving environmental resources or mitigating adverse effects have been noted. The analysis concentrated on botany, terrestrial wildlife, aquatic biology, recreational resources, cultural resources, and existing land uses. Mining and other known past activities that might affect site conditions are also briefly discussed, along with the potential presence of hazardous or toxic materials. Temporary construction related disruptions and impacts are discussed in Chapter 6.

The identification of constraints was conducted at a preliminary, appraisal level of planning, consistent with the current phase of the Investigation. Criteria considered were based, in part, upon criteria commonly used to evaluate environmental impacts of projects under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The application of criteria that may be used for NEPA or CEQA evaluation does not imply that the analysis is at a level that would be needed for an Environmental Impact Statement or Environmental Impact Report. Considerations included: presence of special status species (e.g., species listed as endangered or threatened), species of concern, or sensitive habitats; relative amounts of affected riparian or wetland habitat; effects on native or game fish; conflict with established recreational uses or land uses; presence of nationally registered historic places, sacred Native American sites, or traditional cultural properties; permanent disruption or division of established communities; and loss of energy production facilities.

BOTANY

Overview of Existing Conditions

Annual grassland, oak woodland, and riparian habitats are found in the project area. The possibility of wetlands being present is high. Many of the tributaries are likely to have narrow riparian corridors and possibly seeps and springs.

Mill Creek, a broad alluvial plain with a braided streambed, sustains a sycamore alluvial woodland, a sensitive habitat type that hosts a diverse assemblage of wildlife, particularly birds. An extensive sycamore alluvial woodland has been noted in the lower reaches of Mill Creek near its confluence with the Kings River (COE, 1994). Although sycamore trees are common, sycamore alluvial woodland has been described as a “very rare and essentially irreplaceable habitat type.” (Carson, 1989) There are fewer than six viable occurrences and/or less than 2,000 acres in California and worldwide (Prose, 2002).

Of five special-status species in the area, only one (the tree-anemone) is listed. Suitable habitat for this species is very likely in some tributaries to Mill Creek.

Constraints

Except for the tree-anemone, special status plant species are not likely to be a serious constraint. However, loss of vegetation, particularly riparian habitat, is likely to be substantial. In addition, seeps, springs, and other wetland habitats may be present along many Mill Creek tributaries, and field surveys would be needed to identify these.

Reservoir construction and water diversion are considered threats to sycamore alluvial woodlands, as sycamores have little tolerance to artificially manipulated water levels (Prose, 2002). Sexual regeneration depends upon substantial scour caused by flood events (Enstrom, 2002). Construction of the Mill Creek Reservoir would thus be likely to adversely affect this resource. Replacement of sycamore alluvial woodland is considered unlikely to be successful and its destruction therefore is considered unmitigable (Enstrom, 2002).

Opportunities

Mitigation for impacts to wetlands and riparian habitat would probably have to be conducted off-site because of the magnitude of the potential habitat loss.

WILDLIFE

Overview of Existing Conditions

Mill Creek is a broad alluvium-filled valley. As noted above, an extensive sycamore alluvial woodland is found near the confluence of Mill Creek with the Kings River. This sensitive habitat type hosts a diverse assemblage of wildlife, particularly birds. Beyond the sycamore alluvial woodland, the only notes in the California Natural Diversity Data Base (CNDDB) for sensitive species in the area is the valley elderberry longhorn beetle, federally listed as threatened. The host plant for the beetle can be grown in a number of settings to offset losses by projects. Consequently, its mitigation is relatively easily implemented.

Constraints

Mitigation for the valley elderberry longhorn beetle should be feasible. However, loss of normal runoff flows from Mill Creek could be a significant issue if loss of runoff were to affect the river and habitats below the potential dam. In particular, as discussed above, the loss of sycamore alluvial woodland would be a significant adverse impact. Its replacement is considered unlikely to be successful and its destruction therefore unmitigable (Enstrom, 2002).

AQUATIC BIOLOGY/WATER QUALITY

Overview of Existing Conditions

Mill Creek is a tributary to the Kings River, located just downstream of Pine Flat Reservoir. The stream had little flow at the time of the field visit in May 2002. Flow may cease entirely by late summer, with pool habitat persisting through the dry season. The stream has a braided channel with well-developed riparian vegetation. The stream contained numerous small fish, bullfrog tadpoles and snails. The most likely native fish species to occur in this stream is the California roach. Its presence should be investigated if creation of Mill Creek Reservoir is to be pursued. The San Joaquin form of the California roach has been designated a State Species of Special Concern.

The habitat in Mill Creek is probably also suitable for the exotic species mosquito fish and green sunfish. Rainbow and brown trout reside in Kings River just downstream of the potential Mill Creek dam site, but these are sustained by cold-water releases from Pine Flat Reservoir. Water temperatures in Mill Creek are almost certainly too warm for trout.

Constraints

This project would entail creation of a reservoir with a maximum pool at elevation 800. At maximum pool, the reservoir would inundate about 4½ miles of Mill Creek.

The principal effects of this option on aquatic biological resources result from replacement of stream habitat with lacustrine habitat. Populations of fish and other organisms adapted to a stream environment would be reduced or eliminated from inundated areas, while those of species adapted to lacustrine conditions would be enhanced. The most likely native fish species to be affected would be the California roach, generally not found in lakes.

Opportunities

The principal opportunity afforded by this measure is creation of substantial new fish habitat by the reservoir. Because of its depth, Mill Creek Reservoir would likely stratify each summer. Therefore, the reservoir would provide excellent conditions for both cold-water and warm-water fisheries. Most fisheries would probably be successfully self-sustaining, but regular stocking could increase production.

The proposed Mill Creek Reservoir would likely affect habitat and water quality in the lower Kings River. Assuming water stored in the reservoir would be released from the reservoir bottom, releases would probably maintain lower water temperatures in the Kings River. This reduction in water temperatures would benefit the trout fishery that currently exists in the lower Kings River.

If existing vegetation in the new Mill Creek Reservoir inundation area were not removed prior to reservoir filling, it would be inundated, providing a short-term increase in nutrient levels in the reservoir and enhancing habitat structure. Both effects would likely benefit fish production.

Fish habitat in the new reservoir could be greatly improved if the dam were operated to minimize water level fluctuations, at least during times of year important for fish spawning and rearing.

RECREATION

Overview of Existing Conditions

Recreation facilities are present in Mill Creek at Wonder Valley, a private ranch resort and conference center. Wonder Valley is reported to be the oldest dude ranch in California. It encompasses 75 acres and includes: a dining hall, cocktail lounge, 2 conference rooms, two swimming pools, a gift shop, tennis courts, whirlpool spa, horseshoe area, walking trails, horseback riding stables, a private lake for boating and fishing, basketball courts, athletic fields, a barnyard petting farm and overnight lodging facilities. During the summer months, Wonder Valley hosts children's and family summer camps. The facilities are also available to groups from September through June (wondervalley.com, 2002).

Four developed recreation facilities are located near the confluence of Mill Creek and the Kings River, just downstream of Pine Flat Reservoir. These facilities include the Pine Flat Recreation Area, Choinumni Park, Winton Park, and Avocado Lake Park.

Constraints

Constructing Mill Creek Dam and Reservoir would inundate Wonder Valley Resort, thereby eliminating the recreation opportunities associated with this facility. Some of these lost opportunities could be replaced by constructing new facilities. However, the atmosphere associated with the historic ranch setting would be lost.

The new reservoir would create new water-oriented recreation opportunities. A variety of developed day and overnight facilities could be provided at various locations around the lake. Consideration should be given to development of:

- Parking areas;
- Flush toilets
- Picnic sites with tables, grills, potable water and shade canopies;
- Overnight camp sites with picnic tables, grills, fire rings, and potable water;
- RV facilities including a dump station;
- Boat launching facilities;
- Trails; and
- Information kiosk.

All developed recreation sites should be accessible by paved or graded dirt roads. In addition, all improvements should be designed and constructed to meet Americans with Disabilities Act (ADA) standards.

A new reservoir on Mill Creek could also increase use at other nearby recreation areas located on the Kings River downstream of Pine Flat Reservoir, depending on the type and capacity of facilities provided at the new reservoir. Accordingly, it may be necessary to improve the existing facilities at these sites to accommodate increased use.

Opportunities

The proposed Mill Creek Reservoir would be filled with natural flows from Mill Creek and by diverting water from Pine Flat Reservoir. If diversions from Pine Flat Reservoir were limited to excess flood flows that would otherwise be released, then creation of Mill Creek Reservoir would not affect water levels at Pine Flat Reservoir. As such, recreation activities and opportunities at Pine Flat Reservoir would be unaffected.

CULTURAL RESOURCES

Overview of Existing Conditions

The Mill Creek drainage is the traditional home of the Entimbich, a Numic-speaking group closely related to the Wobonuch and Northfork Mono people (Spier 1978a:426-427). Entimbich people now live in Dunlap, a community on the upper end of the Mill Creek drainage, along with Wobonuch people who were displaced from their former homes along the upper Kings River (White 1996:2, 12).

Specific information is presently unavailable regarding the archaeology of the Mill Creek drainage. Riparian woodland and adjacent Blue Oak woodland suggest a high probability of archaeological sites being present, including habitation sites, bedrock milling stations, and hunting and fishing camps.

Specific information is not readily available regarding the history of the Mill Creek area. However, a variety of sites could be present associated with mining, logging, residential development, and other activities.

Constraints

Numerous cultural resources are known to be present, and there may be additional resources not yet recorded. Inundation of archaeological sites (prehistoric or historic) can result in loss of important scientific data. An unknown number of archaeological sites would be adversely affected by construction of the Mill Creek Dam. No properties eligible for the National Register of Historic Places are known to be present, but future study is likely to identify such properties. No Native American sacred sites or Traditional Cultural Places are known to occur, but Entimbich Mono concerns would be expected.

Opportunities

Inundation damage to archaeological sites can be mitigated with scientific data recovery programs. Reservoir projects also provide an opportunity for public interpretation of the past. Ancillary project facilities, such as roads, power lines, or other structures, may provide opportunities to avoid impact to archaeological sites through design or facility placement.

LAND USE

Overview of Existing Conditions

Many residences and ranches occur along Elmwood Road, including a dude ranch that has been in existence for many years and known locally as an informal community "landmark" (not historically designated) called Wonder Valley Ranch. The road, all structures along the road, and the transmission line along the road would be removed.

Constraints

Removal of Wonder Valley would be a constraint because of its community value. Additional research would be needed to determine to what extent removal of Wonder Valley, Elmwood Road, and the houses on Elmwood Road would represent a significant land use constraint. This would be clarified upon completion of the review of the county General Plan and Zoning Ordinance.

MINING AND OTHER PAST ACTIVITIES

Overview of Existing Conditions

There is no evidence of mining or other past activities in the area that could affect the site.

Constraints

No constraints have been identified.

HAZARDOUS AND TOXIC MATERIALS

Overview of Existing Conditions

Rural residential homes usually have septic systems. The community of Mill Valley may possess, or may have once possessed underground or above-ground petroleum hydrocarbon storage tanks and/or electrical transformers containing polychlorinated biphenyls (PCBs).

Constraints

Potential residuals from septic systems, fuel and lubricant hydrocarbons, and/or from electrical transformers might exist on the site and would require remediation.

CHAPTER 6. STORAGE STRUCTURES AND APPURTENANT FEATURES

ZONED ROCKFILL EMBANKMENT

A zoned rockfill-type dam was considered by IECO in its 1974 study to be the most suitable type for the proposed Mill Creek site. The embankment would consist of an impervious core with outer zones of pervious material. Fine and coarse filters would be located between the impervious core and the downstream rockfill. A filter blanket would be provided downstream of the impervious core.

IECO recommended that the dam crest be at elevation 830. The embankment would be approximately 250 feet high, with a crest length of about 3,700 feet. The dam crest would be 30 feet above the spillway crest and normal full reservoir level of elevation 800, and 10 feet above the surcharge reservoir level of elevation 820. The dam crest width would be 30 feet to accommodate a roadway for upstream access. The overall upstream slope of the embankment would be 1.85:1, and the downstream slope 1.75:1. Approximately 10 million cubic yards of embankment materials would be required.

A core trench, excavated 5 feet into sound rock beneath the impervious core of the embankment, would facilitate cutoff grouting and sealing of the foundation. The average depth of foundation stripping was assumed to be 10 feet. The grout curtain would extend into each abutment. Figure 6-1 is a cross section of the proposed dam from the 1974 IECO study.

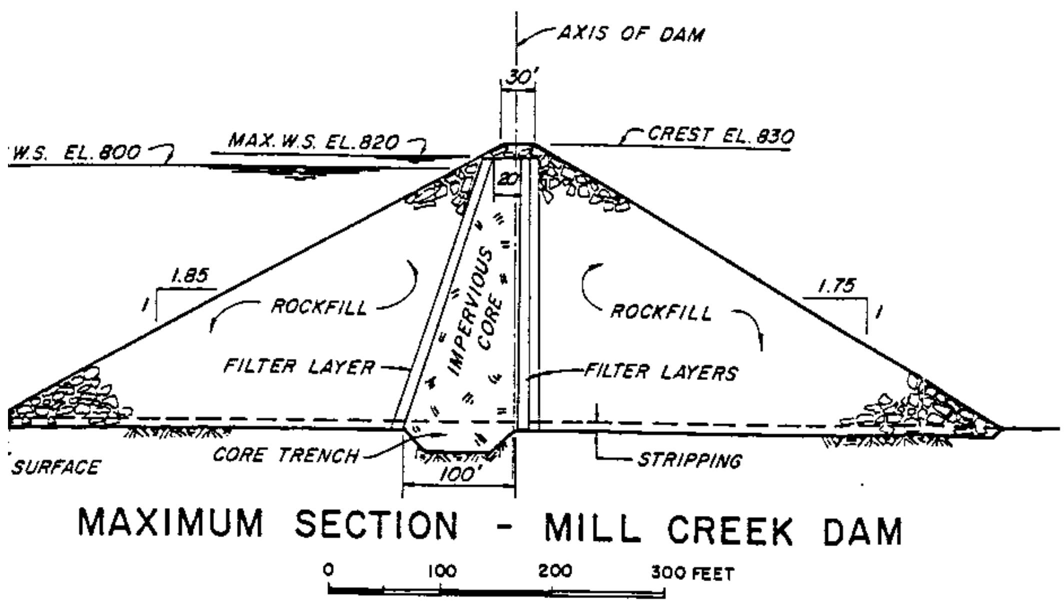

FIGURE 6-1. CROSS SECTION OF THE PROPOSED DAM

RESERVOIR ELEVATION/CAPACITY CURVE

The reservoir elevation versus storage volume curve (adapted from IECO, 19974) is shown in Figure 6-2.

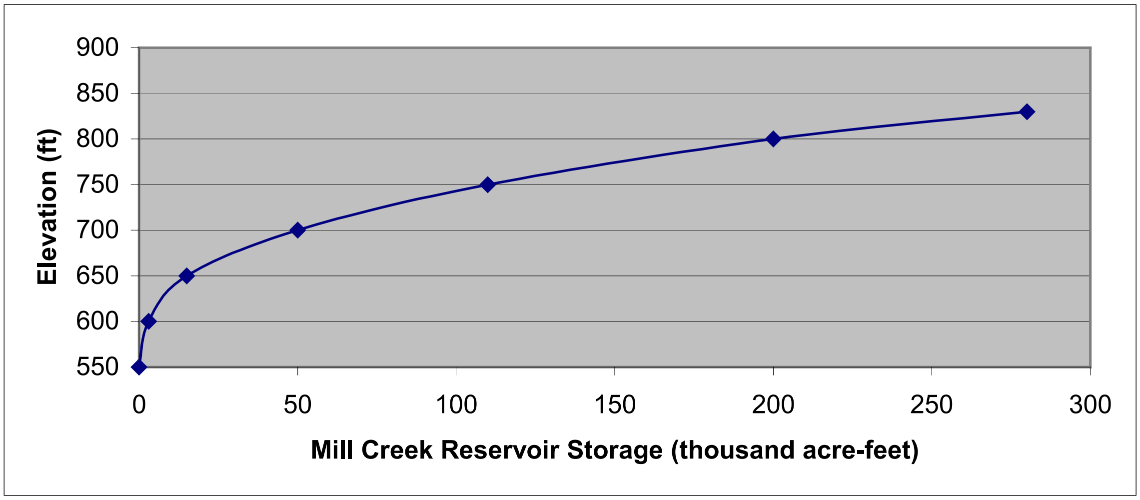

FIGURE 6-2. ELEVATION VS. CAPACITY CURVE

CONSTRUCTABILITY

Land, Right-of Way, Access, and Easements

Public roads lead to the Mill Creek Dam and Reservoir area. Elwood Road would be realigned to traverse the crest of Mill Creek Dam in a northeasterly direction and to continue southeasterly above maximum reservoir level during surcharge (elevation 820) to rejoin the existing road at the extreme southeast limit of the reservoir in Tretten Canyon. The total length of road to be relocated is about 8.0 miles.

Overhead and underground utilities lead to the dam site and service the area below the dam. A high voltage transmission line traverses the area at the proposed top of the left abutment.

Borrow Sources/Materials

A brief reconnaissance of the general vicinity of the Mill Creek damsite indicates the probable existence of borrow deposits of material of sufficient quality and quantity that when processed, would provide the construction materials necessary for the project. Construction materials investigations were carried out previously by Reclamation and the Corps.

The closest known source of impervious materials is located about 2 miles upstream of the proposed dam site, along Mill Creek and its tributaries. Another potential source is the relatively flat flood plain adjacent to the Kings River downstream of the dam site. Portions of this area are presently covered with orange groves.

Alluvial deposits containing material suitable for concrete aggregate exist along the Kings River and the lower Mill Creek valley. Rock suitable for riprap was not specifically investigated; however, it is believed that a quarry could be developed locally. There are hard metamorphic and granitic rock outcrops at several places within 10 miles of the proposed damsite.

Excavation required for the spillway would generate soil and rock that could be used in the dam embankment. Exploration and testing would have to be conducted to assess the suitability of the spillway excavation materials for use in the various impervious, pervious, rockfill and riprap zones of the dam.

Foundations

The dam would be founded on massive, igneous, and metamorphic bedrock.

Power Sources

Nearby electrical power is available from the local distribution grid.

Staging and Lay Down Area

Staging / lay down areas of more than adequate size are available both upstream and downstream of the proposed dam axis.

Contractor Availability and Resources

There are several regional general contractors capable of performing the work necessary to construct the dam.

Construction Schedule and Seasonal Constraints

Construction of the dam would take at least two years and span at least two winters. No seasonal constraints are anticipated other than care and handling of Mill Creek flood flows during the rainy season.

Flood Routing During Construction

The river would be diverted during construction in stages. Initially the river would be left to flow in its current bed until a concrete diversion gallery could be constructed. The river would then be diverted into the gallery by means of earth embankment cofferdams both upstream and downstream of the dam axis. Once construction of the dam was adequately advanced, the gate(s) controlling flow through the diversion gallery would be closed and the reservoir filled.

Environmental Impacts During Construction

Environmental impacts during construction could be mitigated with proper planning and implementation of best management practices. Noise and visual impacts would affect inhabitants of Wonder Valley. Air quality issues could be mitigated by dust control measures for quarry, material processing, and construction of the dam. Quarries and blasting for abutment excavation would require both noise monitoring and vibration monitoring on the dam. A cultural survey would have to be conducted to identify any ancestral American Indian or historic artifacts and construction activities would be restricted in those areas. Importing cement and concrete aggregate from distant sources could cause traffic impacts but with proper planning and coordination with Caltrans, the major impacts could be mitigated. All construction equipment should have spark arresters and fire control equipment should be kept readily accessible during construction. Construction water would have to be controlled as well as provisions made for runoff and erosion control. A spoil control plan would be needed to control any construction related fuels, lubricants, and other materials.

Permits

Both federal and non-federal entities would be sponsoring construction of the dam. This joint sponsorship complicates the permitting process somewhat as federal projects are not subjected to the same level of permitting that are required for non-federal projects.

Given the probable duality of sponsorship, and potential environmental and cultural impacts identified, at a minimum, the following permits and permitting agencies may become involved:

Permit	Permitting Agency
Permit to Construct	DSOD, Fresno County
Encroachment	Caltrans, Fresno County
Air Quality	CARB, Fresno County
Low/No Threat NPDES	RWQCB
Waste Discharge	RWQCB
Blasting	Fresno County
Stream Bed Alteration	CDFG
Fire/Burn	CDF, Fresno County

In addition, the following agencies could be involved in the review of permit conditions:

- Bureau of Indian Affairs;
- Bureau of Land Management;
- State Historic Preservation Office;
- Advisory Council on Historic Preservation; and
- U.S. Fish and Wildlife Service.

In obtaining these various permits, several plans would have to be prepared, submitted to the responsible agencies for review and approval. Some of these include:

- Construction Plan and Summary Documents;
- Quality Control Inspection Plan;
- Highway Notification Plan;

- Blasting Plan;
- Noise Monitoring Plan;
- Water Quality Monitoring Plan;
- Noxious Weed Control Plan;
- Bat Protection Plan;
- Management Plan for Avoidance and Protection of Historic and Cultural Properties;
- Storm Water Pollution Prevention Plan;
- Spill Prevention/Containment Plan;
- Visual Quality Control Plan; and
- Dust Control and Air Quality Plan.

Another important regulatory requirement involves compensation /mitigation for habitat loss. In October 1998, the U.S. Fish and Wildlife Service (FWS) issued their draft Coordination Act Report and Habitat Evaluation Procedure (HEP Analysis). The HEP Analysis delineates how compensation for adversely affected baseline habitat and wildlife conditions is to be determined.

In addition, if power generation is included in a project or is modified for an existing project, the Federal Energy Regulatory Commission (FERC) may become involved in the permitting process.

APPURTENANT FEATURES

Conveyance

To divert excess flood discharges that would ordinarily be released from Pine Flat Reservoir, an approximately 5,000-foot long, 10-foot diameter, unlined tunnel would be constructed between the two reservoirs. The inlet invert at Pine Flat Reservoir would be at about elevation 885, and the outlet invert at Mill Creek about gross pool elevation 800. The tunnel would have a maximum discharge of about 2,500 cfs.

The intake and portal structure would be located on the south bank of Pine Flat Reservoir. It would include trashracks, gates, and slots for a bulkhead or stoplogs. A concrete chute would be provided at the downstream end of the tunnel to discharge flow into Mill Creek Reservoir.

Spillway

An ungated spillway would be located on the left abutment ridge. It would consist of an approach channel excavated in rock, a concrete ogee structure, concrete lined chute, a hydraulic jump stilling basin, and an exit channel that would discharge into Mill Creek.

The spillway crest would be at elevation 800 and have a total effective width of about 150 feet. Discharge at water surface elevation 810 would be 11,600 cfs. Peak discharge would be about 35,000 cfs at a reservoir level of elevation 820.

Outlet Works

The intake for the outlet works would be a reinforced concrete structure on the left abutment that would house trash racks and slots for stoplogs. The outlet tunnel through the left abutment would be about 2,000 feet long. An emergency valve chamber would be provided in the tunnel, along with a 1,100-foot long, 48-inch diameter steel conduit for releasing irrigation flows from the emergency valve chamber to the outlet structure.

The outlet works would include a 48-inch control butterfly valve and fixed-cone dispersion valve that would discharge into a steel-lined energy dissipation structure. A concrete lined stilling basin would lead to a riprap lined exit channel downstream

COSTS

Initial Construction Costs versus Storage Capacity

The cost estimate for the proposed Mill Creek Dam and Reservoir was based on the 1974 IECO study and updated to April 2002 unit costs using Reclamation Construction Cost Trends. Costs were also evaluated by MWH dam cost estimators and costs were modified to reflect current material costs and standards of practice especially with respect to seismic requirements. Summaries of the estimated costs are presented in Table 6-1 and Appendix C.

TABLE 6-1
ESTIMATED PROJECT INITIAL COSTS

Component	2002 Cost (Millions)
Main Dam	$132
Spillway	$8
Outlet Works	$7
Tunnel	$15
Unlisted Items	$24
Contingency	$46
Mitigation	$12
Total Field Cost	$243
Invest/Design/CM	$36
Land	$17
Total Project First Cost	**$296**

The estimated total first cost for the proposed Mill Creek Dam and Reservoir project is $296 million. Field costs represent the estimated cost to construct identified features, plus provisions for unlisted items (15 percent), contingencies (25 percent), and mitigation (5 percent). Total project costs include field costs plus estimated costs for future analyses and planning documentation, development of designs, and construction management (15 percent).

Operations and Maintenance Costs

Operations and maintenance (O&M) costs were not evaluated in any of the previous studies of the proposed Mill Creek project and have not been estimated for this appraisal level report.

SYSTEMS OPERATIONS

The following summarizes results of the IECO reservoir operation study and other studies based upon it.

Normal full reservoir capacity	200,000 acre-feet
Full reservoir elevation	800 feet
Minimum reservoir capacity	2,000 acre-feet
Minimum reservoir elevation	610 feet
Average annual flows (natural and diverted)	50,500 acre-feet/year
Average annual increase in water yield	22,000 acre-feet/year

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CHAPTER 7. HYDROELECTRIC POWER OPTIONS

PUMPED STORAGE CONSIDERATIONS

The project does not include any power facilities.

ADDED HYDROELECTRIC POWER TO EXISTING STRUCTURES

There are no existing facilities.

NEW HYDROELECTRIC POWER

No new hydroelectric power is anticipated.

TRANSMISSION AND DISTRIBUTION

Existing transmission and distribution facilities are located nearby.

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